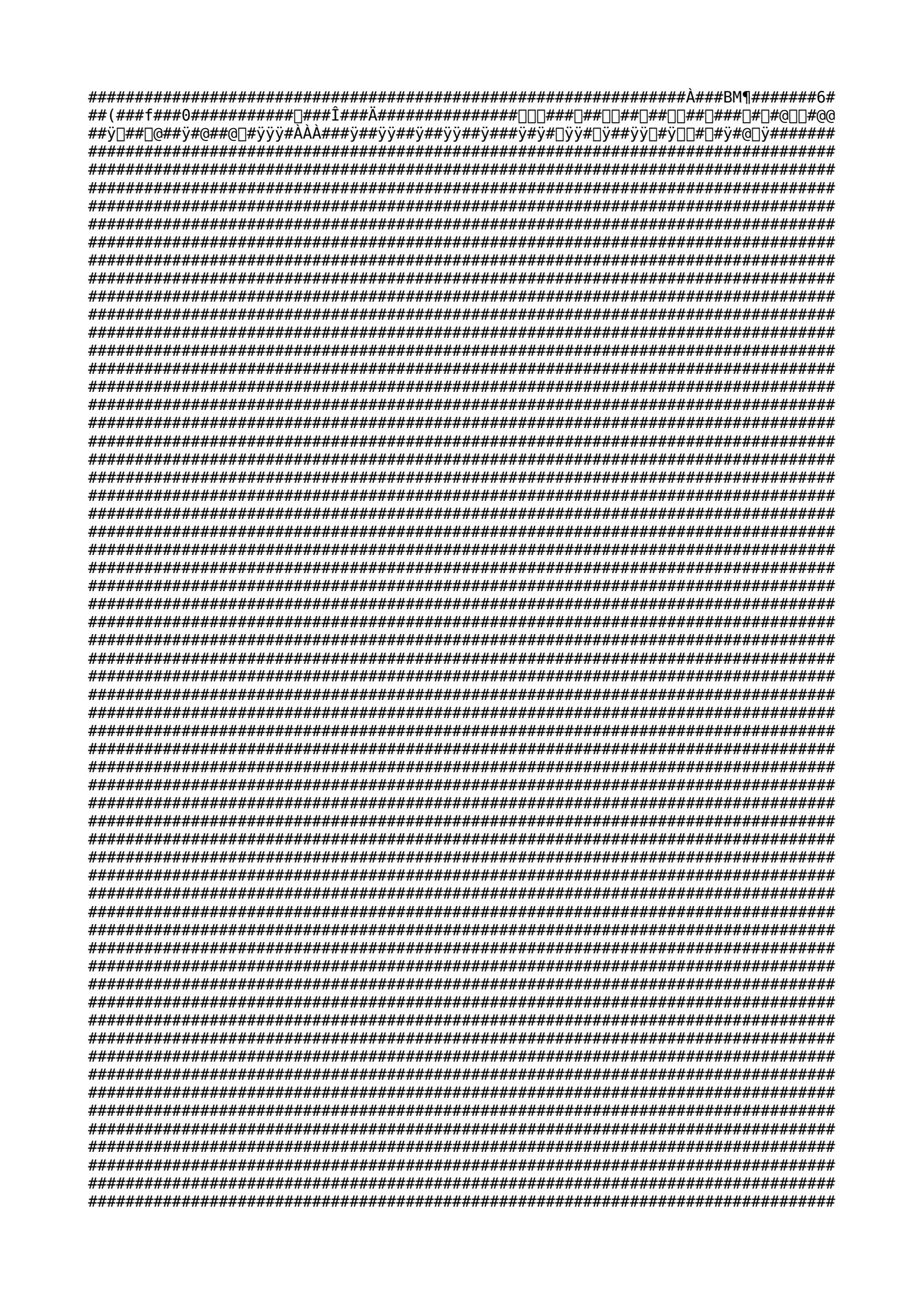

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Cúÿÿ####ÿÿ#####ÿ##ÿÿd#########d#########6###EDCS Refines and Shortens #the Plan-Do-Check-Act Cycle

################# #########################ÿ□#ÿÿd#########d#########2##□##□û-ü##ãÿÿÿ####ÿÿ#####ÿ##ÿÿd#########d#########□###Explore design space Propose candidate solution architecture(s) Gather reusable components that fit architecture locate and evaluate existing componentsþ

```
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###,####ÿ□#ÿÿd#########d#######2####ÿ□#ÿÿd#########d#######'####ÿ□#ÿÿd#########d
#########2##□##□û####C#ÿÿ####ÿÿ#####ÿ##ÿÿd#########d#########D###Analyze
candidate solution architecture(s) #with respect to a set of desired
properties/constraintsRapidly prototype unprecedented components,      adapt
existing components, or generate new onesTest  and understand proposed solution
Evolve proposed solution dynamicallyin accordance with constraints on the
architecture
```

```
#################,##########################ÿ□#ÿÿd#########d#########2##□##ªö□üV
      s#ÿÿ ###ÿÿ#####ÿ□#ÿÿd#########d#########X###Raise Level of Abstraction #
for Building Systems##Enhance System Evolvability
```

```
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      àû############ýÿ##\#ÿh# A□pöPû□    □
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#n#ÿÿ####ÿÿ#####ÿ##ÿÿd#########d#########ì###Limitations           EffectSingle
Architectural Style     Limited ApplicabilitySingle Modeling Formalism
      Incomplete Coverage(Finite State Machines)Fixed Analysis Tool Set
      Limited FeedbackFixed set of constraints Unchecked Requirements
```

```
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d#########Ú###
```

Limitations Effect

Single Architectural Style Limited Applicability

Single Modeling Formalism Incomplete Coverage

Fixed Analysis Tool Set Limited Feedback

Fixed set of constraints Unchecked Requirements

```
#################
#########################ÿ#ÿÿd#########d#########2####û####C#ÿÿ####ÿÿ#####ÿ#
#ÿÿd#########d#########D###Analyze candidate solution architecture(s) #with
respect to a set of desired properties/constraintsRapidly prototype
unprecedented components,      adapt existing components, or generate new ones
Test  and understand proposed solutionEvolve proposed solution dynamicallyin
accordance with constraints on the architecture
```

```
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#####1##□##ºû#ÿzÿU#ÿÿ####ÿÿ#####ÿ##ÿÿd#########d#########M###join, resign
declarationsexport dataownership transfertime synchronization#
```

```
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####ÿ##ÿÿd#########d#########9###comm management,network configuration,status
monitoring#
```

```
#-###############################$###########-
##############ÿ□#ÿÿd#########P############ÿ□#ÿÿd#########P#########1##□##ÒõD#C
w#ÿÿ####ÿÿ#####ÿ##ÿÿd##########d########/###Complementary Analyses Detect
Additional Faults#
```

##ÿ□#ÿÿd#########Z#########1##□##êõm#÷þQ#ÿÿ####ÿÿ#####ÿ##ÿÿd#########d#########-### Event Order Anomalies Causality Anomalies #

```
############################################ÿ□#ÿÿd#########d#########1##□##êõÍ#□
ÿ£#ÿÿ####ÿÿ#####ÿ##ÿÿd#########d#########C### Insufficient Preconditions Faulty
Control Model Latent Deadlocksÿ
```

```
#2#########2#################2##############ÿ□#ÿÿd#########Z############ÿ□#ÿÿd##
#######Z#########r##□##ZõÆ÷¦
\úÿÿ ###ÿÿ#####ÿ□#ÿÿd#########d#########?###Real Specifications Have Faults#DMSO
Simulation Framework (HLA)#
```

```
#6###############################$###############################$###########6##
############ÿ□#ÿÿd#########Z############ÿ□#ÿÿd#########Z#########1##□##*#¥#ù
      ##ÿÿ####ÿÿ#####ÿ##ÿÿd#########d#########D### Same Thread Required
Causality-Driven#     Protocol Verification
```

#-#########-#################-#########-####ÿ□#ÿÿd#########n#########r##□##Zõø¦
£úÿÿ,###ÿÿ#####ÿ□#ÿÿd#########P#########K###Real Specifications Have Faults#
X/Open Distributed Transaction Processing #

```
#################,##########################ÿ□#ÿÿd#########d#########2##□##ªöðü6
#□#ÿÿ####ÿÿ#####ÿ□#ÿÿd#########Z#########m###Notation appropriate #    for
applicationConcise Specification Increased UnderstandingSimplified Evolution#
```

```
##########################################ÿ□#ÿÿd#########d#########1##□##ÐöYûÒ
#-ÿÿÿ####ÿÿ#####ÿ##ÿÿd#########d#########□### Process Criticalities Periodic &
Aperiodic Processes Preperiod Deadlines Mode changes for dynamic#   system
reconfiguration#
```

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ÿd#########d############ÿ□#ÿÿd#########d############ÿ□#ÿÿd#########d############
ÿ□#ÿÿd#########d############ÿ□#ÿÿd#########d#########1##□##°õ·#Ýýi#ÿÿ####ÿÿ#####
ÿ##ÿÿd#########d#########8### Slack-based aperiodic Incremental Processor &
Channel

##ÿ#ÿÿd#########d##########2####xö?
ü##Cýÿÿ####ÿÿ#####ÿ##ÿÿd#########d#########,###Especially critical for Domain Specific ADLs

#################
#########################ÿ□#ÿÿd#########d#########2##□##□û####C#ÿÿ####ÿÿ#####ÿ#
#ÿÿd#########d#########D###Analyze candidate solution architecture(s) #with
respect to a set of desired properties/constraintsRapidly prototype
unprecedented components, adapt existing components, or generate new ones
Test and understand proposed solutionEvolve proposed solution dynamicallyin
accordance with constraints on the architecture

#################(##########################ÿ□#ÿÿd#########d#########2##□##-
öýþ\#Ó#ÿÿ####ÿÿ#####ÿ##ÿÿd#########d#########¾###Strong Type Checking Early
Error DetectionAdvanced Parameterization Improved ReuseFunctional & Higher-
Order ArgsDomain-specific   Appropriate Modeling#   Embedded Languages
Formalisms

```
#################(##########################ÿ□#ÿÿd#########d#########3##□##Ðöi##
#□#ÿÿ####ÿÿ#####ÿ##ÿÿd#########d#########a###  Multiple Compilers to span
      Flexible Design#       flexibility/performance space Efficient Code#
```

```
#0#########0#####,###########0#########0####ÿ□#ÿÿd#########d#########2##□##Tõ{üB
#6#ÿÿ####ÿÿ#####ÿ□#ÿÿd#########d#############          Measure   Baseline
Domain                Contractor  12X Code/Test Cycle      Manual      C2
Message Handler   OGI  10X Defects  Manual      C2 Message Handler      OGI  50X
Spec. Size  Manual      C2 Message Handler      ISI100X Code/Test Cycle Manual
      C2 Message Handler      ISI    9X Spec. Size    Manual      GN&C (Control-
H)    Honeywell  18X Spec. Size    Manual      GN&C (Meta-H)    Honeywell  25X
Execution Speed   JFAST Transportation Planning Kestrel350X Execution Speed
      ADANS Transportation Planning Kestrel¥   X Code/Test Cycle  Manual
      Transportation Planning Kestrelw
```

#################
##########################ÿ□#ÿÿd#########d#########2##□##□û####C#ÿÿ####ÿÿ#####ÿ#
#ÿÿd#########d#########D###Analyze candidate solution architecture(s) #with
respect to a set of desired properties/constraintsRapidly prototype
unprecedented components,   adapt existing components, or generate new ones
Test and understand proposed solutionEvolve proposed solution dynamicallyin
accordance with constraints on the architecture

#################,##########################ÿ□#ÿÿd#########d#########2##□##
ý□#6#g#ÿÿ####ÿÿ#####ÿ□#ÿÿd#########F#########□###Heterogeneous Components &
ConnectorsCORBA, IIOP, COM, DCOM, & RMI messagesDistributedNon-Intrusive
ObservationMeaningful timing analysisõ

#################
##########################ÿ□#ÿÿd#########d#########2##□##□û####U#ÿÿ####ÿÿ#####ÿ#
#ÿÿd#########d#########D###Analyze candidate solution architecture(s) #with
respect to a set of desired properties/constraintsRapidly prototype
unprecedented components,   adapt existing components, or generate new ones
Test and understand proposed solutionEvolve proposed solution dynamicallyin
accordance with constraints on the architecture

#################,##########################ÿ□#ÿÿd#########d#########2##□##zö#ý# #□#ÿÿ####ÿÿ#####ÿ□#ÿÿd#########d#########ÿ###Dynamic LanguagesLocalize Information Single Point of ChangeAutomate Reference DependenciesConsistent UpdatesDelay Commitments to Run-Time   Usage Determines #   Adaptation GeneratorsModify Specification & Regenerate   Simpler to Modify#   Code Generation#

```
#3#########3#################3#########3####ÿ□#ÿÿd#########d#########2##□##¬ö$##
#ä#ÿÿ####ÿÿ#####ÿ##ÿÿd#########d#########:###Correspondence between Model and
Implementation maintained
```

```
#################
#########################ÿ□#ÿÿd#########d#########2##□##□û####U#ÿÿ####ÿÿ#####ÿ#
#ÿÿd#########d#########D###Analyze candidate solution architecture(s) #with
respect to a set of desired properties/constraintsRapidly prototype
unprecedented components,      adapt existing components, or generate new ones
Test  and understand proposed solutionEvolve proposed solution dynamicallyin
accordance with constraints on the architecture
```

```
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Ö
##ÿÿ####ÿÿ#####ÿ##ÿÿd#########d#########á###COTS Dynamic Language
      Commercial SupportAutomate Construction  Lower Cost#   of  Generators
      Earlier AvailabilityArchitecture Driven Generators   Adapt to Architecture
Integrated Tool Suites  End-to-End #        Architecture Support#
```

```
#################,##########################ÿ□#ÿÿd#########d#########2##□##ªö□ü¦
□ÿÿÿ####ÿÿ#####ÿ□#ÿÿd#########□#########U###            Feature          Effect
Comprehensive Arch. Analysis  Early Design Feedback#
```

```
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þ©û#þªû#þ¬û#þû#þ®ûÿý¯ûüý°ûúý±ûøý²ûöý³ûóý´ûñý´ûïý##########Ú######r##□##JöÝ÷Ö
súÿÿ####ÿÿ#####ÿ##ÿÿd#########d#########:###High Assurance:  The CHECK in #the
Plan-Do-Check-Act Cycle
```

```
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